



US009409355B2

(12) **United States Patent**
Johnson et al.

(10) **Patent No.:** US 9,409,355 B2
(45) **Date of Patent:** Aug. 9, 2016

(54) **SYSTEM AND METHOD FOR IMPREGNATING FIBER ROVINGS**(71) Applicant: **Ticona LLC**, Florence, KY (US)(72) Inventors: **Aaron H. Johnson**, Winona, MN (US);
David W. Eastep, Winona, MN (US);
Timothy A. Regan, Winona, MN (US)(73) Assignee: **Ticona LLC**, Florence, KY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 212 days.

(21) Appl. No.: **13/707,673**(22) Filed: **Dec. 7, 2012**(65) **Prior Publication Data**

US 2013/0147082 A1 Jun. 13, 2013

Related U.S. Application Data

(60) Provisional application No. 61/569,055, filed on Dec. 9, 2011.

(51) **Int. Cl.**

B29C 70/52	(2006.01)
B05C 3/12	(2006.01)
B05D 1/26	(2006.01)
B29C 41/30	(2006.01)
B29C 47/02	(2006.01)
B29B 15/12	(2006.01)
B29C 47/14	(2006.01)
B29C 47/00	(2006.01)
B29C 47/10	(2006.01)
B29C 47/70	(2006.01)
B29C 47/08	(2006.01)
B29K 105/08	(2006.01)
B29K 105/10	(2006.01)

(52) **U.S. Cl.**CPC **B29C 70/523** (2013.01); **B05C 3/125** (2013.01); **B05D 1/265** (2013.01); **B29C 41/30**(2013.01); **B29C 47/027** (2013.01); **B29C 70/526** (2013.01); **B29B 15/122** (2013.01);
B29C 47/004 (2013.01); **B29C 47/0021** (2013.01); **B29C 47/0898** (2013.01); **B29C 47/1036** (2013.01); **B29C 47/14** (2013.01);
B29C 47/70 (2013.01); **B29C 47/705** (2013.01); **B29K 2105/0872** (2013.01); **B29K 2105/106** (2013.01)(58) **Field of Classification Search**None
See application file for complete search history.(56) **References Cited**

U.S. PATENT DOCUMENTS

2,734,224 A	2/1956	Winstead
3,803,965 A	4/1974	Alderfer
4,531,959 A	7/1985	Kar et al.
4,588,538 A	5/1986	Chung et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP	0287427 A1	10/1988
EP	0312842 A2	10/1988

(Continued)

Primary Examiner — Benjamin Schiffman(74) *Attorney, Agent, or Firm* — Dority & Manning, P.A.(57) **ABSTRACT**

A die and method for impregnating at least one fiber roving with a polymer resin are disclosed. The die includes an impregnation section. The impregnation section includes an impregnation zone configured to impregnate the roving with the resin. The impregnation zone includes a plurality of contact surfaces. At least one of the plurality of contact surfaces is configured such that a normal force of the roving is less than or equal to a lift force of the resin at an impregnation location on the contact surface during impregnation of the roving with the resin by the contact surface.

28 Claims, 19 Drawing Sheets